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Human Capital and the Inclusive Economy

The Treasury

Abstract

This paper draws on recent empirical evidence to look at how human capital policies in New Zealand can achieve "Inclusive Economy" objectives. In particular it looks at evidence on policies that are best to promote growth, and to improve the distribution of well-being; whether they are the same, and the extent to which they involve trade-offs.

Compared to other OECD countries, New Zealand appears to have relatively high rates of participation in tertiary education, and at least average performance on measures of achievement amongst school students. Nevertheless, in common with other English speaking countries, it tends to have a relatively wide dispersion of skills both amongst school students and in the working age population. There is some suggestion that New Zealand is not making as much progress as other countries (Australia in particular) in raising skills among the less able, in new generations of school leavers.

Taken over all, the paper suggests a two-pronged strategy. Firstly, policies should aim to increase the incidence of world-class tertiary education and research relevant to industry. Given already high levels of public and private investment in tertiary education, this should involve redesign of institutional and funding arrangements, rather than large amounts of extra public resources. Secondly, policies should aim to raise the skills of the less able entering the workforce. Interventions in early childhood and primary schooling are likely to be most effective in the long term – though, given the current large stock of low skilled adults, a continuing search for effective working-age interventions to address this will also be worthwhile.

***JEL classification*:** H5 National government expenditures and related policies, I2 Education, J3 Wages, compensation, and labour costs

***Keywords*:** Human capital, education, economic growth, distribution of earnings

CONTENTS

SUMMARY

Purpose

This report looks at how human capital policies can help achieve "Inclusive Economy" objectives. In particular, it looks at evidence on the following questions:

- What sort of human capital policies would be best for New Zealand to pursue to raise economic growth?
- What human capital policies should it use to improve the distribution of well-being?
- Are these policies the same? In what way do they differ? To what extent is there a trade-off in pursuing these objectives. For example, do they involve competing demands on scarce resources?

Human capital is linked with earnings, economic growth and well-being

"Human Capital" has been defined as "acquired human capabilities, which are durable traits, yielding some positive effects upon performance in socially valued activities"[1]. It has many dimensions, and is acquired through a range of processes, in a variety of settings (family, school, firms and the community).

A wide range of policies may be used to influence its accumulation – though typically most governments in developed countries substantially rely on direct provision, and, more widely, the funding of formal education at all levels. Second order policies include support for families in undertaking the task of raising children, non-tertiary labour market training, adult literacy programmes and certification and subsidy of training provided or purchased by employers.

Over the last 40 years, the human capital literature has established a strong and consistent association between years of education, qualifications and higher earnings. Though less certain, and less robust, an association between human capital and economic growth has also been established.

In addition, education is positively associated with a range of other individual and societal goods – for instance, healthier life-styles, lower propensity to commit crime, higher levels of trust, richer social networks, and greater participation in volunteering and in democratic institutions. Moreover, higher levels of human capital in one generation of families and communities are strongly associated with higher levels in the next.

The literature has not reached consensus as to how much these associations represent causal effects, and how far they represent other causal factors correlated with human capital. There is uncertainty, too, about the extent to which the associations represent "reverse causality" – for instance, countries which grow faster or have higher output per capita, spend more on education. There is also a question about how far the effects on growth found for a larger sample of countries apply to OECD countries – where it is possible that there are diminishing marginal returns to additional average years of education. Moreover, to a greater or lesser extent, the relationship between education and individual earnings may be due not only to the

[1] David (2001). Because the weight of empirical evidence uses education as a proxy for human capital, the discussion in this paper is often focused on education, rather than the broader range of skills and capabilities encompassed by the term "human capital".

skills and capabilities imparted by education, but also to educational qualifications being used to "signal" innate ability to employers.

Nevertheless, recent empirical studies using better data and methodologies support a growing consensus (see Temple, 2000) that, even for OECD countries, there is a causal relationship between average years of education and the long-run level of output per worker. There is also evidence that, in many OECD countries, there has been a long term rise in the earnings premia accruing to well-educated workers, despite increasing supply of such workers. In a number of countries, this has been associated with a widening dispersion of earnings, particularly over the last 20 years. Likewise, labour economists tend to accept that the association between education and earnings represents real productivity effects, with true annual returns to an extra year of education being in the order of 5–15%.

Human capital is a complement to technological progress

Economists generally conceive long-run growth in output per worker as being due to technological progress. Some economists place particular emphasis on the process of technology creation and adoption as the driver of economic growth. They emphasise the role of experts engaged in industry research and development – though, obviously entrepreneurs and managers capable of adapting organisations to take advantage of technological innovation are also important. Other economists emphasise the importance of a skilled workforce, capable of utilising new "skill-biased" technologies in the workplace. Some, indeed, argue that the availability of such workers induces the creation and adoption of new technologies.

Rapid "skill-biased" technological progress may partly explain a widening dispersion of earnings

Many economists believe that skill-biased technological progress is also the main cause of increasing skill premia, and a widening dispersion of earnings in many OECD countries, particularly over the last 30 years. Analysis suggests that, even with an increasing supply of tertiary educated workers, skill premia are not likely to reduce quickly, and may continue to rise.

In sum:

- High rates of economic growth are likely to require a mix of highly skilled technical specialists, skilled entrepreneurs and managers capable of seeing and putting in place new opportunities for productivity gains, and workers with good, medium-level skills to operate new "skill-biased" technologies.

- The most effective human capital policies to reduce dispersion and improve adequacy of earnings are likely to be those that increase the skills of those in the bottom part of the skills distribution. There is also reason to believe that raising human capital in the bottom of the distribution (as opposed to elsewhere) will have particular benefits for other aspects of individual well-being and a well functioning society.

New Zealand has high rates of participation in tertiary education…

By OECD standards, New Zealand has high rates of enrolment in tertiary education, high graduation rates and also high participation in other forms of adult education and training. As graduates enter the workforce, replacing less educated workers, New Zealand should be able to maintain or even increase its ranking in terms of average

years of education in the working age population[2]. Its best graduates are able to enter top universities around the world, and some have successful top ranking careers overseas.

Nevertheless, two areas stand out for further policy development and action. One, improving the quality of selected parts of tertiary education to world-class, is primarily relevant to raising economic growth. The other, raising skills among the less able, while making its main contribution through improving the distribution of well-being, will also raise employment and productivity.

New Zealand has been remarkably successful in rapidly increasing the output of tertiary graduates over the last 15 years, while keeping real government outlays tightly constrained. This has been achieved through bulk funding tertiary institutions on the basis of student numbers, with students expected to contribute a part of tuition costs (able to be financed through student loans). This bulk funding includes an element to cover research – but does not provide strong incentives for excellence in research. Quality assurance systems are designed to ensure tertiary providers exceed minimum standards. The main mechanism to make provision responsive to the needs of the economy is student demand for courses, which in turn is presumed to be impacted by differences in labour market returns to educational investments.

… but there is room to increase the number of world-class centres of research and teaching

However, New Zealand is a small, remote, open economy which operates in an international labour market for the most skilled workers. It is competing with a number of higher-income countries for the best academic workers. It is very unlikely that policies that aim at a uniform standard across the tertiary system, will reliably produce world class centres of research and teaching. No country has the resources to afford a uniformly world class standard of provision in its universities.

While some recognised centres of excellence do exist, it is possible that a careful choice of funding and institutional arrangements could lead to the emergence of more, in areas of particular relevance to New Zealand's economic growth. Encouraging selected areas of world-class provision requires internationally competitive salaries. Building on emerging centres of excellence, particularly where they can demonstrate effective linkages with relevant industries, could reduce the risk of wasted resources. Internationally, it is not uncommon for research centres (often associated with teaching) to be funded through a tendering process that provides sufficient continuity to allow strategic investments to be made, but that also provides strong incentives for performance.

New Zealand can support only a limited number of such centres. However, they could play a significant role in the identification and adoption (and, in some areas, the creation) of relevant technologies by attracting and retaining top staff and students, and building linkages with industry and overseas centres, across which knowledge can be transferred. The particular design of institutions and funding policies are likely to be important for giving industry, students and tertiary managers the confidence to make the investments that will yield productivity gains in the longer term. A degree of experimentation may be required to find the best arrangements.

[2] Compared to many OECD countries, New Zealand has a relatively young population. As better educated younger cohorts replace older cohorts of workers, New Zealand is well placed to improve relative overall levels of education in its workforce.

New Zealand has a comparatively wide dispersion of achievement …

On a range of measures of achievement and skills across countries, New Zealand, together with other English speaking nations, appears to have a relatively wide dispersion of scores. In reading literacy our average scores for school children rank amongst the best in the world, but we do relatively worse for the bottom 25%. New Zealand ranks in the top three countries for mathematics for the top 25% of young people at the age of final year of schooling; but earlier in the school system our rankings on average scores are middling. A relatively high proportion (perhaps 20%) of our students leave school at age 16 and do not participate in further formal education and training.

…and may be falling further behind in skills at the bottom

Amongst countries participating in the International Adult Literacy Study, we rank among the bottom half in mean scores on two of the three scales. Moreover, the proportion of the youngest cohort (16 – 25 year olds) with the lowest level of literacy shows little improvement on older cohorts, unlike many other countries participating. It is particularly striking that we appear to be falling well behind Australia in this respect, and in participation of young people in formal education through the ages 16 to 18.

Improving the skills of school-leavers will be most cost-effective in the long term

Addressing this pattern of poor skills requires a two-pronged strategy – one to reduce the numbers of young people leaving formal education without adequate skills to secure stable employment, and the other to improve skills for those already in the workforce. Because of the cumulative nature of educational investments, early interventions in pre-school and primary education are likely to be most cost effective in the long run. Of particular importance are foundation skills in literacy and numeracy, which provide the platform for later learning both in school and the workforce. Though many other skills are also relevant, such skills have been shown to have a strong link with labour market success independent of levels of education. Many other jurisdictions, for instance the United Kingdom, are placing strong emphasis on initiatives that lead to measurable improvements in foundation skills.

Importantly, there are interventions that have been shown to be effective in raising these skills amongst disadvantaged children, and progress is relatively easily monitored, helping in the selection and refinement of such interventions. By and large they need to find ways to engage families and communities in partnerships with schools in pursuit of learning objectives. The Strengthening Education in Mangere and Otara (SEMO) project is a promising New Zealand initiative of this type.

Increasing skills in the bottom part of the distribution in the current working age population is desirable – but evidence on effective policies is sparse

Addressing low levels of human capital in the adult population raises different issues. First there is no strong evidence that second chance education is particularly effective in securing better labour market and earnings outcomes. In the short to medium term, evidence supports concentrating on getting persistently unemployed persons into work as a first priority. However, policies to increase human capital may have other benefits, and may be as effective in improving labour market outcomes – though not as cost-effective as "work first" policies – over the longer term. Focusing on employment, with supported work-based training, may be an effective alternative.

Overall, there is a need to gain a better understanding of what policies are effective in which circumstances and for whom. This can only be achieved through experimentation and good evaluation of policies as they are implemented in New

Zealand, and drawing on learning from other jurisdictions. It also requires a better understanding of the characteristics of people who have persistent difficulties in securing stable employment.

Improving tertiary education for technological progress should not require large amounts of additional government resources

Policies aiming to increase the incidence of world-class tertiary education and research relevant to industry do not require large additions to existing publicly provided resources. This will involve only a small proportion of all tertiary provision, and high private rates of return provide strong incentives for individual students to contribute their own resources (assisted by the student loan scheme). More selective funding, coupled with suitable institutional arrangements could lead to significant improvements[3].

Worthwhile progress in raising skills at the bottom of the skills distribution may require significant additional government resources

On the other hand, determined efforts to reduce the incidence of low skills among new entrants to the working age population are likely to require significant additional resources – but again careful work is required to identify the most cost-effective policies. Much less is known about the capacity to raise basic skills in the adult population – suggesting a cautious approach, with expansion dependent on successful evaluation. Recent work in the United Kingdom (Bynner et al., 2001) suggests that if successful in raising skills, such initiatives could have substantial benefits not only for the individuals concerned, but also for social outcomes, productivity, economic growth and fiscally.

[3] Data supplied by the Ministry of Education and OECD data (OECD 2000a, Table B4) for 1997 suggest that New Zealand's ratio of per student public expenditure in tertiary education, to that in primary (or secondary) is already comparatively high among OECD countries.

INTRODUCTION*

An inclusive economy can be seen as having three main, interlinked components: social capability, productive capability and well-being. The key objective in an inclusive economy is to improve people's well-being. The concept draws on the links between a productive and innovative economy and a strong, cohesive society, and how each of these contributes to well-being. It directs policy at ensuring broad-based opportunities to participate in society and the economy as the key route to improved well-being.

The overall objective in the inclusive economy is the well-being of New Zealanders. Well-being derives not only from average material living standards but also the distribution of income and a range of social characteristics such as values, trust, participation, cohesion and people's freedom to do the things that they have reason to value.

A strong association between human capital and well-being has been established …

The relationship between "human capital"[4], individual well-being and the characteristics of a well functioning society are widely recognised. Over the last 40 years the human capital literature has established a strong and consistent association between years of education, qualifications and higher earnings. Though less certain, and less robust, an association between human capital and economic growth has also been established.

In addition, education is positively associated with a range of other individual and societal goods – for instance, healthier life-styles, lower propensity to commit crime, higher levels of trust, richer social networks and greater participation in volunteering and in democratic institutions. Moreover, higher levels of human capital in one generation of families and communities are strongly associated with higher levels in the next.

Thus, governments of all complexions and in most countries in the developed and developing world have put major effort into achieving increased levels of human capital, primarily through the funding and provision of formal education.

… but many policy questions remain

Nevertheless, important questions remain for policy, even in the broadest context.

- Will human capital policies[5] chosen to be best for increasing economic growth (narrowly measured) also be best for improving the overall level and distribution of well-being? If not, in what way do they differ? How much will policies aimed primarily at improving the distribution of well-being also increase growth? Further, to what extent do alternative objectives compete for government funding, and, if so, how much will one need to be traded for the other, in deciding on the allocation of funding?

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[4] David (2001) defines "human capital" as "acquired human capabilities, which are durable traits, yielding some positive effects upon performance in socially valued activities".

[5] While a wide range of policies can influence human capital formation, the phrase "human capital policies" in this paper refers primarily to policies purposefully designed to affect the level, diversity and relative availability of human capabilities.

A wide range of secondary questions follow:

- What dimensions of human capital are most important for well-being?
- What is the importance of formal education compared to other influences on human capital formation – e.g. families, workplaces and the community? What scope has government to affect human capital formation through these other channels?
- Which level of formal education (early childhood, primary, secondary, tertiary) should receive additional policy attention?
- Where should new resources be allocated or existing resources re-allocated, by mode of education and subject area?
- Given a strong role for private decisions by families, individual students, education providers and firms, what is the appropriate role for government? What problems does government involvement address? What problems does it entail? What sort of institutions and what regulatory, funding and financing arrangements are best?

The purpose of this paper is to improve the basis for reasonable judgements on a number of these issues, in the New Zealand context.

SCOPE

Part one looks at the mechanisms by which the accumulation of human capital contributes to economic growth, and evidence on the importance of these mechanisms. It is mostly based on a report commissioned by the Treasury from Paul A. David, All Souls College, Oxford and Stanford Universities, entitled "Knowledge, Capabilities and Human Capital Formation in Economic Growth"[6]. It also draws on recent empirical evidence, including an OECD cross-country study of the determinants of growth (OECD 2000b, Temple 2000, Bassanini and Scarpetta, 2001).

Part two looks at the evidence on how policies designed to influence the formation of human capital can be used to influence the distribution of income. It draws on a report commissioned by the Treasury from Daron Acemoglu, Department of Economics, Massachusetts Institute of Technology entitled "Human Capital Policies and the Distribution of Income: A Framework for Analysis and Literature Review" (Acemoglu, 2001b).

An initial focus on per capita average income and the distribution of individual incomes is useful, because it allows some quantifiable analysis of human capital effects across countries, and across time in a way that is not easily achievable for other channels by which human capital contributes to well-being.

Part three looks at the implications from Parts one and two for growth and distributional objectives taken together.

Part four considers whether and how the policy implications from Parts one and two need to be modified in light of evidence on a broader set of channels by which human capital policies influence well-being. This relies on empirical research reported in an OECD paper "The Well-being of Nations: The Role of Human and Social Capital: Human and Social Capital and Sustained Growth and Development" (OECD 2001a).

Part five describes relevant features of the level and distribution of human capital in New Zealand over time, using a variety of data sources that allow international comparisons.

Part six draws tentative conclusions about opportunities for improving well-being in New Zealand through human capital policies. It refers to current broad policy settings and outlines areas where future policy development may be most fruitful.

6 David (2001).

PART ONE HUMAN CAPITAL AND ECONOMIC GROWTH

The purpose here is to outline economists' understanding of the mechanisms by which human capital influences economic growth, the evidence at a broad macro-economic level for the importance of those influences, and historical and micro-economic evidence on how these mechanisms have operated in major developed economies.

Human capital has many dimensions, and is acquired through a variety of processes in different settings

In considering this evidence, several points need to be considered:

- Human capital is formed in a number of different settings, cumulatively over an individual's life time. There are a wide variety of processes by which people acquire skills and capabilities.

- Human capital has many dimensions, which can influence productivity and hence growth in a variety of ways, both directly and indirectly.

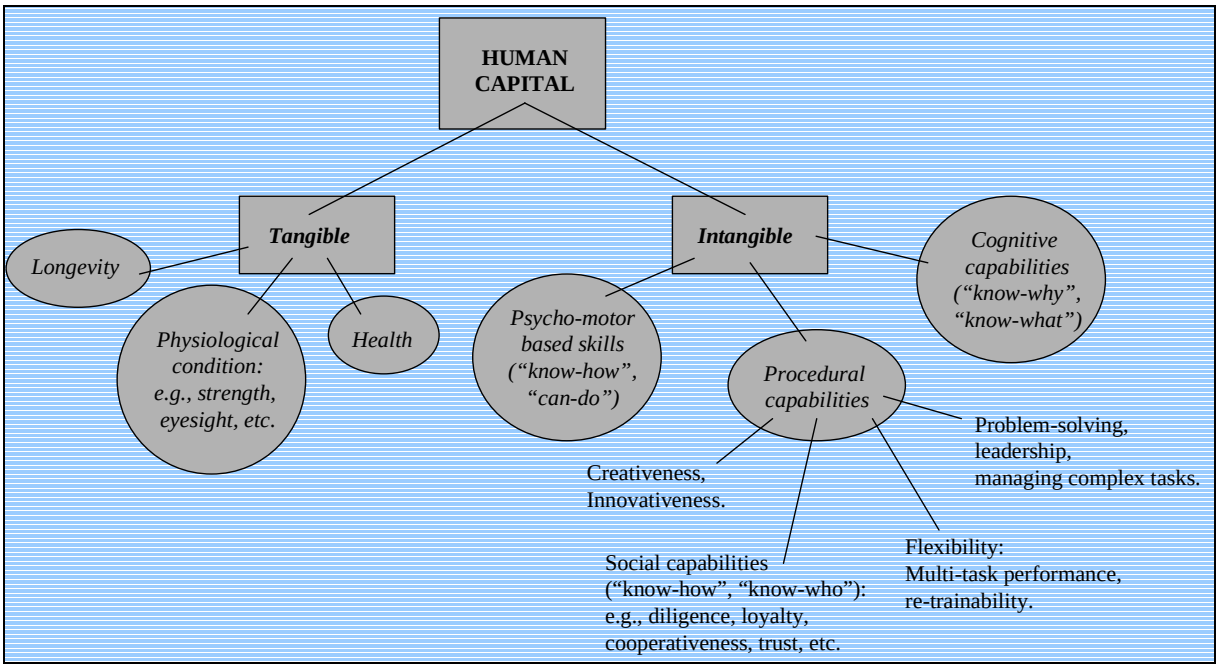
- There are positive feedback loops connecting individual and societal outcomes. For instance, capabilities in one generation influence the acquisition of capabilities in the next. Higher productivity and earnings allow more resources to be devoted to human capital investments. In addition, human capital acquired early in life, makes it easier to acquire more human capital later on. Understanding these processes will be important for identifying where policies are likely to have the largest long-term impact.

Measures commonly used in empirical work, or for the purposes of policy evaluation, usually capture only a small part of this complexity. Government policies have more direct influence on some factors influencing human capital formation, than others. In sum, it is inherently exceedingly difficult to ascertain the true effects of human capital policies on individual and societal well-being.[7]

These points are illustrated in the following pages by Figures 1 and 2 from David (2001):

[7] Some of the important issues that need to be considered in assessing the empirical evidence are set out in the Appendix.

Figure 1. Human capital: a taxonomy



Source: David (2001)

Purely private decisions about human capital may not lead to the best outcomes for society

A further issue, highlighted by Figure 2 is that human capital formation is substantially shaped by the decisions of families, young people, education providers and firms. There are a number of reasons why private decisions by themselves may not lead to the best level and type of human capital formation for society as a whole. Some important instances are:

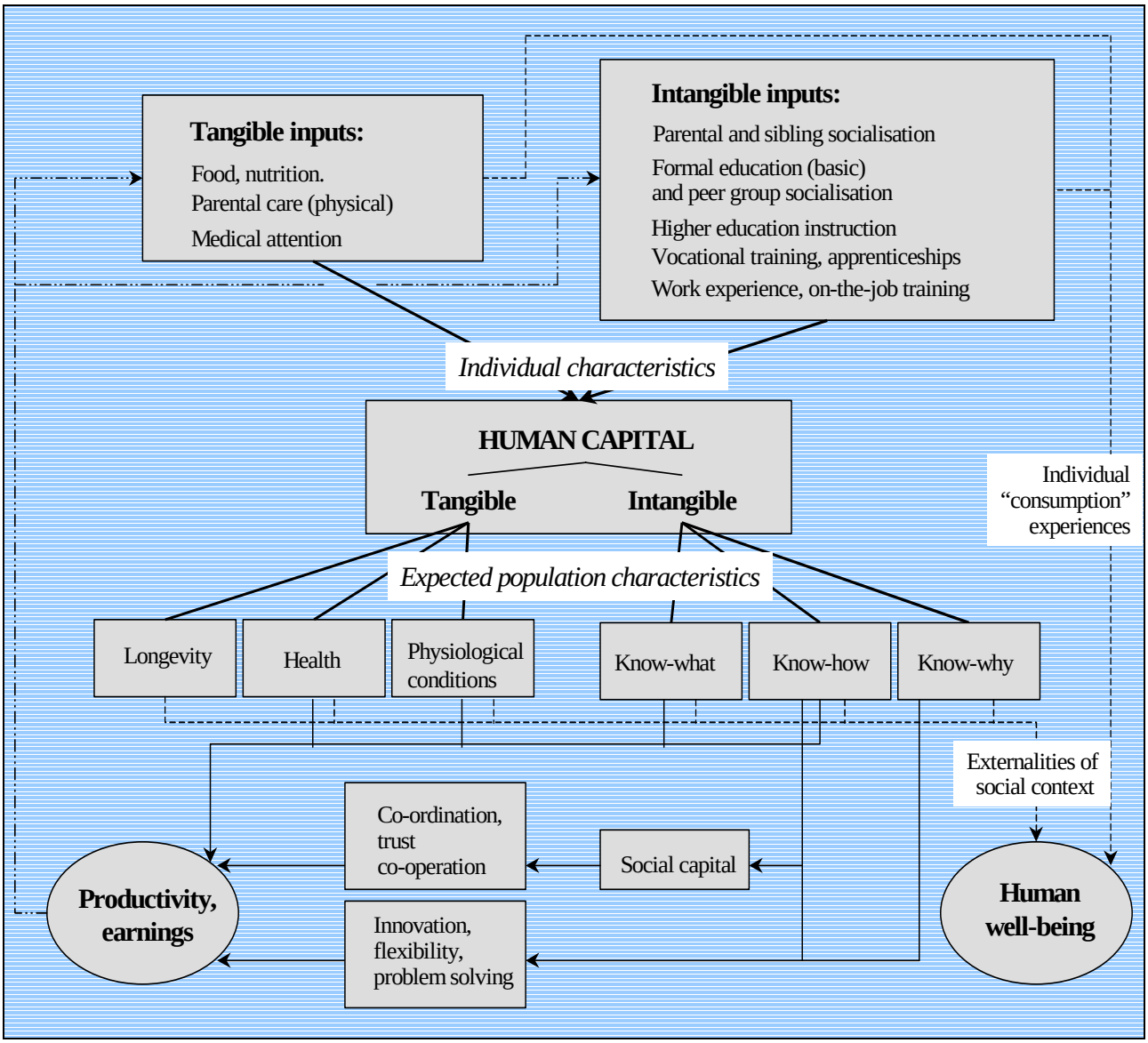
- Individuals may not have the means to support themselves while they are undertaking education and training and may not be able to borrow for this purpose (with the intention of repaying loans through higher earnings later on).

- Human capital acquired by one individual may benefit many others (for instance through a lower probability of crime, or through enabling more productive technologies to be used). However individuals may mostly only consider the direct benefits to themselves (through earnings, job satisfaction, or social status for instance) in deciding how much and what type of human capital to acquire.

- In labour markets that are not fully competitive, employees may not get the full benefit of their skills in terms of earnings. Their employer will get a pecuniary benefit from their skills that employees do not take into account when making their education decisions[8].

[8] This effect, and those covered in the next two bullet points apply to all investments, not just education.

Figure 2. Human capital formation and growth: micro- to macro-level feed-backs



Source: David (2001)

- It is difficult for individuals (students and education providers[9]) to tell what sorts of knowledge, skills and capabilities will be in high demand many years into the future. Likewise, firms investing in new technology may not know whether workers will have the skills needed to use it when it comes on stream. Firms, education providers and students might have different expectations about the future, leading to a mismatch between skills and technology. Unless they can co-ordinate their expectations, each might find it better to wait before making specific education and technology investments.

- Employers and workers may not be able to agree on the provision of workplace training, because authorities enforcing contracts might find it difficult to verify whether appropriate quality training has been provided. Workers might be

9 Bureaucrats and politicians will face a similar difficulty in a publicly managed system.

unwilling to accept lower wages to reflect lower productivity during training, unless they are confident they will receive good quality training.

- Individuals may spend time and trouble to acquire qualifications, even when they do not thereby acquire much greater capability, because employers value qualifications as a sign that the holder has natural ability, and can be more readily trained[10]. (This may imply that the social value of education will be less than the private value.)

David and many other economists believe that these are among the reasons why government policies can lead to better outcomes for social well-being than if decisions were left up to private individuals alone, using their own resources. Of course, in practice, governments typically have a large involvement in funding, financing, regulating and providing education and training. The relevant policy question is not whether government should be involved, but what the nature and level of that involvement should be, and what changes to the status quo will lead to improvements in well-being. These issues will be explored further in the New Zealand context in Parts five and six.

Human capital and macro-economic growth - theory and empirics

The causal relationship between human capital and growth is far from settled either theoretically or empirically

Economists have modelled and estimated the relationship between human capital formation and economic growth across countries, in a variety of ways posing differing implications for policy.

An earlier generation of growth models (following Solow, 1956, 1957 and Swan, 1956) required an assumption of ongoing efficiency enhancing technological change to explain positive "steady state" growth rates in labour productivity. The models allowed a distinction between factors (such as the accumulation of physical capital per unit of labour), which cause a shift in the steady state *level* of labour productivity[11], and factors (such as technological change) which affect the *growth* rate, itself.

More recent models have explicitly introduced human capital, and in various ways assumed that technological change occurs as a result of economic activity itself. In one strand of models following Lucas (1988), human capital is another input into production, but one for which there are not diminishing returns to scale. In the other strand, following Romer (1990), Young (1991) and Aghion and Howitt (1992), the main contribution of human capital to growth is through technological innovation. In both cases, positive steady state rates of growth in per capita output are explained by "spill-overs" from human capital[12].

As David argues, the two strands make distinctive predictions about the relationship between human capital and steady-state growth of output per unit of labour: "When skilled labour is considered solely as an input for production, the growth of output can only be affected by different rates of human capital accumulation, but when human capital is thought of as a factor of innovation, growth is sensitive to the level of the

[10] Referred to as the "signalling" effect of education – see Part two.

[11] This result is due to an assumption of diminishing marginal returns to factor accumulation.

[12] David (2001) provides a brief discussion of this theoretical literature. For a more extended discussion, see, for example, Jenkins (1995).

human capital stock[13]." Cross-country empirical studies have, however, at least until recently, struggled both to find robust effects on output of rates of accumulation and level of human capital, and, in any case, to convincingly distinguish between them.

David concludes that there is only weak empirical evidence for the hypothesis that *changes* in the human capital stock affect growth rates, but strong evidence for the *stock* of human capital having an effect. However the effect of the *stock* on growth rates diminishes as the average level of human capital grows – and is small in OECD countries[14].

The most recent evidence (see Temple, 2000; OECD, 2000b; Bassanini and Scarpetta, 2001), using superior data sets and methodologies, does, however, find a positive relationship between changes in the stock of human capital in OECD countries and increases in output per capita[15]. Bassanini and Scarpetta estimate that an increase of one year in average years of education in the working age population has a long–term effect on the level of output per capita of roughly 6%.

In a different line of research, Hanushek and Kimko (2000) find that measures of labour force quality derived from international science and mathematics tests of school aged children appear to be strongly associated with average growth rates, in a sample of mostly developed countries over the period 1960-1990. Variation in test performance is a much stronger predictor of growth than variation in years of schooling alone. In particular, a one standard deviation improvement in an index based on performance over a range of tests leads to a 1 percentage point increase in average annual growth rates over the period[16].

However, the relevance of much of this evidence to policy is limited by a number of factors.

First, the contribution of human capital to growth in output is limited, in cross-country models, by "convergence". Countries with already higher levels of output per capita (and, usually with higher average years of schooling in the working age population) have less scope to increase output through further human capital accumulation[17].

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[13] As Jenkins (1995) points out, the Romer type of model more specifically predicts that it is the stock of human capital in research and development that determines the long run growth rate in labour productivity. This has rarely been directly tested empirically. Jenkins cites the example of Ochoa (1994), who, for three manufacturing sectors in 11 OECD countries finds a positive effect of scientific human capital on productivity growth rates. Nevertheless, Ochoa acknowledges the causality of this relationship is hard to pin down.

[14] See Krueger & Lindahl (2000).

[15] They argue that the effects are too large to be consistent with a simple neo-classical growth model, but nevertheless note that it is unclear whether to interpret the result as representing an effect on the steady state level of output per unit of labour, or an effect on the steady state growth rate itself. They "conservatively" opt for the former interpretation (OECD, 2000b).

[16] Within the limitations of the data, Hanushek and Kimko test for reverse causality, omitted variable bias, and the effects of East Asian countries which have had high growth rates, and perform strongly on the mathematics and science tests. They remain puzzled by the strength of the relationship they have found between test performance and economic growth – it may partly reflect mis-measurement of the schooling variable, and suggest that their results are supportive of the idea that there are strong externalities to quality of schooling (as measured by test scores). They also investigate countries whose actual growth rates are not well explained by test scores. One such country is the United States, whose growth rate is stronger than would be expected from test scores. They suggest that this may reflect the acknowledged excellence of tertiary education in the United States – a factor not investigated in their study.

[17] Though, taken at face value, the Hanushek and Kimko (2000) evidence suggests that improvement in quality of education (measured by achievement levels) may continue to be an effective route for raising output, even for countries with high average years of education.

Temple (2000) thus argues that the main value of the findings is to give comfort to OECD governments that they have not over-invested in education. David, for similar reasons, concludes that aiming at a general raising of average years of schooling would not be a useful policy for New Zealand.

Historical and microeconomic studies provide further evidence on the mechanisms which link human capital to growth

Second, conventional empirically estimated macro-economic growth models have a number of serious limitations. Important amongst these is that they abstract from historical processes, and do not identify the underlying mechanisms that link education to growth. Economic history draws attention to growth characterised as a process of extended transitions, driven by technological innovations, between steady-state growth paths. David argues that since the early 20th century, skill biased technological progress has been the main force leading to the rise in importance of human capital compared to other inputs into production, and that this was largely *not* the result of government policies to subsidise mass education. These, in fact, were *induced* by changes on the demand side of the labour market.

David argues that the increased demand for educated workers was particularly associated with a need for organisational change in industry associated with the dissemination of new general-purpose technologies (such as factory electrification, and, more recently, the microelectronics-based digital computer).

Over the same period in the United States, technological progress stimulated "an increasing demand for scientists and engineers and supporting personnel, who could carry on the necessary knowledge-generating and knowledge-applications activities". Abramovitz and David (1999) document how colleges and universities in the United States responded to this demand, (driven by the need for financial backing from industry either directly or through taxation) through adapting curricula, and establishing new areas of study.

Looking at the comparative 20th century growth experience of the United States, Britain and Germany, Broadberry (2000) concludes that, while they had similar levels of school enrolments, their productivity records were quite different. He attributes this to varying emphases on vocational training and formal education. The United States specialised in higher level skills (particularly for managerial and research tasks) from formal education, that were used in mass production in combination with unskilled labour. Germany followed the opposite path – specialising in intermediate skills learnt though vocational training, which were used in a handicraft, "flexible system" of production. Britain tried to accumulate both types of human capital, and fell behind the United States in high level skills, and Germany in intermediate ones[18].

David concludes: "This … reinforces the general message that a simplistic view of human capital accumulation cannot yield an adequate account of the historical patterns of growth: the industrial path followed – mass production or flexible production; oriented

[18] Nickell and Van Reenen (2000), surveying the period since 1970, reach a similar conclusion, though their emphasis is on British managerial skills lagging those in the United States, and middle-level technical skills lagging those in Germany. More generally, OECD (2001b) p.31, following Gemmell (1996) and others points to evidence that: "Higher education is particularly important [for growth] in OECD countries …". However, unlike the most recent studies, Gemmell does not use data for the human capital stock corrected for mismeasurement, nor panel data methods made possible by annual data (instead averages across a 25 year period are used in the regression). It is doubtful that much reliance should be placed on this finding for policy purposes.

to industry or services – determines the need for different kinds of human capital, and this in turn depends on the resources and conditions of the country."

David draws attention to "the important implications of the reciprocal links between technological change and human capital formation". The supply of human capital of various sorts enables new technologies to be developed, adopted and operated. To a large extent however, human capital formation responds to and is guided by demand coming from the labour market. Particularly in the short term, inadequate supply side responses may produce "widening pay differentials or increased rates of occupational obsolescence and structural unemployment".

A range of cross-country and within-country microeconomic studies investigate the relationship between human capital, technology adoption and productivity in particular industries. For instance Bartel and Lichtenberg (1987) find that relative demand for educated workers was greater in sectors where newer vintages of capital equipment had been installed; and Wolff (1996) finds that in United States industries in the period 1970-85 the growth of cognitive skill levels among employees was positively correlated with indicators of recent technological change. Nickell and Nicolitsas (1997) find that persistent skill shortages in a firm's industry lead to permanent reductions in its fixed capital investment and temporary reductions in research and development expenditures. Stoneman and Kwon (1996) demonstrate the relationship between technology adoption and profitability in the United Kingdom engineering industry.

Zucker et al. (1988) study the relationship between the growth and location of relevant scientific research, the role of outstanding scientists, and the growth and location of the biotechnology industry in the United States in the 15 years following 1975[19]. Moretti (1999) finds that manufacturing plants (particularly those using human capital intensive production) in cities with a better-educated population are equipped with better technology, and have higher productivity[20]. Berman and Machin (2000) find that the transfer between countries of skill-biased technology is central to the increased demand for skilled workers in the manufacturing sectors in middle-income countries.

Summary

Taken together, the macro-economic, historical and micro-economic evidence all lend firm support to the idea that productivity and economic growth are driven by skill-biased technological progress. This is dependent on the supply both of highly skilled experts and managers – associated with the creation and adoption of new technologies – and a workforce with good general skills to operate them.

[19] Their work suggests that "star" scientists with a commercial interest in appropriating the benefits of their research played an important role in the growth of the industry.

[20] He argues, from analysis of longitudinal data, that the most likely explanation is human capital spill-overs from learning amongst workers.

PART TWO HUMAN CAPITAL POLICIES AND THE DISTRIBUTION OF INCOME

Education, skills and capabilities are correlated with earnings

Data across time and countries show a strong positive correlation between individuals' education, skills and capabilities, and their earnings. To the extent that governments are concerned about a widening distribution of income, or more particularly about the adequacy of incomes towards the bottom of the distribution, it is natural to consider the role that human capital policies can play.

If a widening distribution of earnings reflects increasing premia for skills[21] in short supply, then it might be possible to reduce dispersion by producing greater numbers of highly educated workers. On the other hand, raising the skills of the low skilled may be more effective in increasing the adequacy of their earnings, as well as in narrowing the overall distribution of earnings.

However, if, as some economists believe, the relationship between education and earnings reflects to a significant extent its value to employers as a signal of innate ability, rather than of acquired skills, then human capital policies might not be effective in improving distributional outcomes. Acemoglu (2001b) synthesises the theoretical and empirical literature on each of these questions.

Skill-biased technological change helps explain a widening dispersion of earnings

He concludes that:

- While other factors are relevant (e.g. deunionisation, openness to trade, welfare provisions), skill-biased technological change and consequent increases in skill premia are a major contributor to increased earnings inequality in OECD countries[22].

- Greater openness to trade does not appear to have been a major factor in the widening of the earnings distribution.

- Standard supply and demand analysis suggests that an increased supply of skill will reduce skill premia, other things being equal. However, technologies adjust to the supply of skills[23], and, the historical record in the United States suggests (see figure 3) that the effect of increased supply on skill premia is likely to be small[24]. On realistic assumptions about the rate at which other labour will be substituted for college educated labour as its wage rises[25], Acemoglu estimates

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21 The term "skill premium", defined empirically in a number of ways, refers to the extent to which earnings of skilled workers exceed those of the unskilled.

22 He notes that while increased returns to education account for some of the increase in earnings dispersion, there is evidence for increased returns to skills within education categories, which will account for more of the increase in earnings dispersion. He considers that the analysis based on premia for education will apply more generally to all skill premia (see Acemoglu 2001b).

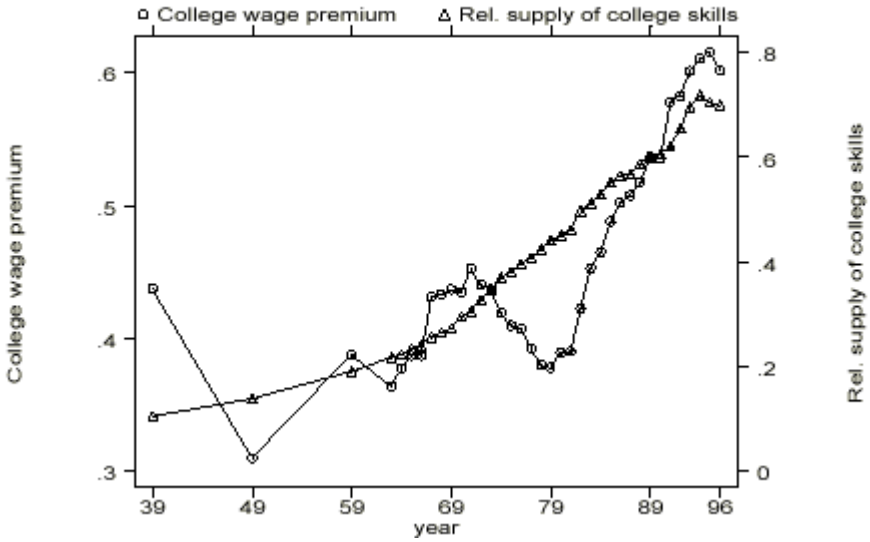
23 Acemoglu refers to his own work on this (1998, 1999) & argues that it applies as much to technology adoption as to technology creation. The essential point is that an increase in the supply of skills creates, in part at least, its own demand. (See also Nickell & Nicolitsas, 1997).

24 Maani (1999) shows that returns to education in New Zealand increased strongly over the period 1981 to 1996, and were accompanied by rapid increases in participation in tertiary education, translating into a steady rise in the proportion of the working age population with tertiary qualifications – see Figure 4.

25 Technically referred to as the elasticity of substitution between college educated and other labour.

that the relative demand for the latter has increased by 200-300% between 1940 and 1990, having accelerated after 1970.

Figure 3. Relative supply of college skills and college premium (U.S)



3

The behaviour of the (log) college premium and relative supply of college skills (weeks worked by college equivalents divided by weeks worked by non-college equivalents) between 1939 and 1996. Data from March CPSs and 1940, 1950 and 1960 censuses.

Source: Acemoglu (2001)

- In any case, because the flows of skills are small relative to the stock, this mechanism would take a long time to have any effect on earnings dispersion, even without increased demand. Acemoglu calculates that an economy that doubles its output of college-educated workers would reduce skill premia by only 16 per cent after 10 years[26]. Similarly, immigration will have little effect on skill premia [27].

- It might be expected that higher skill premia will be self-correcting through encouraging further schooling. However, as noted above, the effect of increased supply on skill premia is limited, and, moreover, in some data there is a surprising lack of correlation between education premia and education investments[28]. Nevertheless, Acemoglu acknowledges that the evidence on this is ambiguous.

- As Figure 4 shows, the broad New Zealand data for the last two decades does suggest that rising returns to education investments were accompanied by an increase in tertiary education completion.

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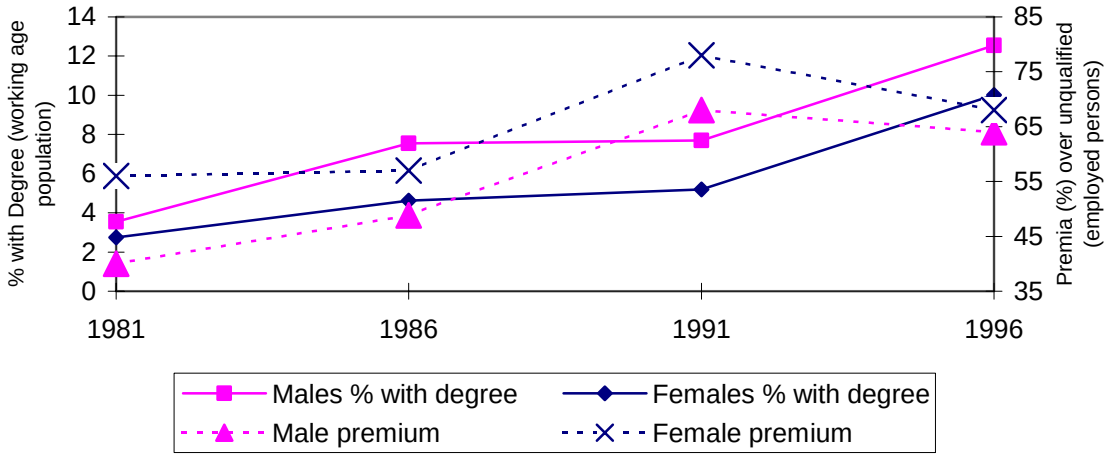
[26] This result depends on empirical estimates of the rate at which other labour is substituted for college-educated labour, as wages of the latter rise. Acemoglu postulates an economy that starts with 25% of its workers college educated.

[27] He refers to U.S. research by Card (1990), and by Borjas, Freeman & Katz (1997), in support of this.

[28] Acemoglu & Pischke (2000) analyse college enrolments across U.S. states and find no correlation between wage inequality and changes in college enrolments. They argue that migration effects, which might explain this, are limited. They also look at cross-country evidence in the OECD and come to the same conclusion. They acknowledge, though, that the increase in enrolments in the U.S. during the 1980s is consistent with demand-induced increases in supply.

Figure 4. Supply of graduates and income premia for degree 1981-1996 (New Zealand)



Source: Maani (1999)

- Reducing the dispersion of skills (by raising those in the bottom tail of the distribution of skills) is likely to be the most effective human capital policy to address income dispersion and particularly adequacy issues[29].

- However, if a significant part of the relationship between education and earnings were due to "signalling effects" then increasing educational attainment in the bottom tail might not be effective in reducing dispersion. Evidence from the United States, controlling for age and cohort effects[30], suggests, however, that changes in signalling effects are not very important in explaining changes in skill premia. Other evidence looks at whether social returns to compulsory schooling (measured through average earnings) are similar in magnitude to private returns, and concludes that they are[31]. This also supports the idea that signalling effects are small.

- In the United States changes in the types of jobs that firms create ("good jobs" versus "bad jobs") may have been important in shaping the wage distribution[32]. However, this is likely to have been driven by technology – and does not affect the conclusion about putting a top priority on raising the skills of those towards

[29] Recent research using data from the International Adult Literacy Study shows that differences among countries in skill premia explain more of the cross-country variation in the distribution of earnings, than do differences in the distribution of skills. (See Devroye & Freeman, 2001; Blau & Kahn, 2001). This suggests that while making an important contribution, policies that compress the distribution of skills will not, by themselves, eliminate differences in the distribution of earnings across countries.

[30] This evidence looks at whether changes in skill premia, or the demand for skill occurred within groups of workers defined by particular cohorts and ages. For the period 1970 – 1990 there were increases in skill premia within these groups (see Table 2, Acemoglu 2001b).

[31] Acemoglu & Angrist (2000). The methodology relies on across state variations in compulsory schooling laws, as a means to identify the true effects of additional years of schooling.

[32] Acemoglu argues that there may be pecuniary externalities to more productive high-quality jobs, due to imperfectly competitive labour markets enabling employees to bargain to higher wages. Employers do not take these benefits to employees into account, which leads to an under supply of such jobs from an efficiency perspective.

the bottom of the distribution of skills. In Acemoglu's model, raising skills at the bottom can induce an increased supply of better jobs.

Literacy and numeracy skills are particularly important for improving labour market outcomes of those in the bottom part of the distribution of skills

A large body of accumulated evidence (e.g. Bishop, 1992; Murnane et al. 1995; Pryor & Schaffer, 1999; Murnane et al. 2000) suggests that cognitive skills have become increasingly important for individual employment and earnings outcomes in developed countries. New Zealand analysis (Maré and Chapple, 2000) of data from the International Adult Literacy Study shows that, as in other countries, even when educational attainment is taken into account, literacy and numeracy skills appear to have an additional effect on outcomes. New Zealand is among a group of countries where there is a particularly strong earnings penalty to having only low-level literacy and numeracy skills[33].

Recent research in the United Kingdom (Machin et al. 2001) using longitudinal data from the National Child Development study suggests that raising numeracy skills is particularly important for improving labour market outcomes for those in the lower part of the distribution of skills (while improving literacy has a stronger effect for those who are already well skilled). The research also suggests that basic literacy and numeracy have a more important and more robust effect than a range of other "soft skills"[34] and attitudes on labour market outcomes.

While other skills (for instance capacity for team work, problem solving and adaptability) are undoubtedly also important, little systematic evidence is available on how these skills are acquired, variations in them across the population, or their effects on labour market outcomes. It is thus difficult, at present, to design robust and reliable policy interventions around these skills.

[33] See OECD and Statistics Canada (1997), Figure 2.2.

[34] Measured by school attendance, teachers' and parents' views of the individual's social skills and ability to interact with others at age 16, respondents' assessment of their own people skills, and caring skills.

PART THREE HUMAN CAPITAL, ECONOMIC GROWTH AND THE DISTRIBUTION OF INCOME

Skill-biased technological progress is an important driver of economic growth and partly explains a widening dispersion of income in some countries

Parts one and two together suggest that:

- There is reasonably strong evidence that skill-biased technological change has played a strong role in economic growth in developed economies over the last 70 years, and, at least over the last 25 years, has played a significant role in the widening of the distribution of income in a number of countries[35].

- The relationship between skill-biased technological change, economic growth and the distribution of earnings is complex, and influenced by a range of factors. Much will depend on the circumstances of particular countries: the sectoral structure of their economies; the way in which their industries are organised; labour market regulation and welfare policies; the nature of formal and informal education and their linkages to industry; and the quality and distribution of the existing stock of human capital. In addition, increased supply of skilled labour may, itself, induce further technological change. Countries show marked differences in both growth patterns and the trajectory of income inequality over time[36].

Countries with a wide dispersion of skills are likely to experience a widening dispersion of earnings in the face of rapid technological change

- All else being equal, it is likely that the faster the pace of skill-biased technological change, the more likely there will be a widening dispersion of earnings.

- Countries that utilise a high-skill/low-skill mix of labour inputs (see Broadberry, 2000) are likely to be more vulnerable to a widening dispersion in the face of rapid skill-biased technological change. This is partly because the current level of human capital in families and communities has a strong effect on formation of human capital in the next generation. Similarly, much human capital is formed "on-the-job" – people who have only worked in low skilled jobs will have a weaker base from which to adapt to new skill-biased technologies.

- An important issue for New Zealand is that it is a small, open, middle-income country, competing in an international market for highly skilled labour. To an extent, earnings at the top of the distribution of skills are likely to be set externally, irrespective of the numbers of skilled workers produced locally.

Technological progress requires a mix of highly specialised and general skills

- Technological progress drives growth, and seems to require at least the following types of capabilities (aspects of which are not acquired primarily through formal education):

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35 Acemoglu notes that while there is an academic debate, many economists believe that the speed of skill-biased technical change has been somewhat faster over the past 25 years. Acemoglu (2001a) summarises and evaluates the evidence.

36 These issues are touched on in Treasury (2001b).

- People who have the high technical skills (in the appropriate areas) and creativity to create or adopt new technologies – and behind this, people who have high levels of generic skills that will enable them to learn efficiently specific technical skills demanded by emerging technologies;
- People with the required entrepreneurial and management skills to identify opportunities, organise the financing of investments, and design and manage new ways of organising to make optimal use of new technologies;
- People with the skills to operate the new technology and to work effectively in the new forms of organisation. While there is evidence that cognitive skills have become more important, a range of other skills and qualities are also important, including the ability to work in teams, to problem solve, and to be adaptable.

- On the other hand, the most effective human capital policies to address income adequacy and income distribution concerns are likely to be aimed at raising the skills of people in the bottom part of the distribution of skills.

Raising skills in the bottom part of the distribution will reduce pressures on other policy instruments

In addition to direct effects on well-being, improving skills to address distributional concerns will reduce the need to use other instruments (such as income transfers, labour market regulation, and taxation) which appear to have adverse effects on economic growth over the longer term[37]. As Part Four discusses, raising skills at the bottom will likely have other positive effects on social functioning that may also have indirect effects on economic growth.

Comparisons with other developed countries will help guide where New Zealand should put its effort

If the best human capital policies to improve the production of skills for growth are different from those to raise incomes for those at the bottom of the distribution of skills, and each require large amounts of extra resources, then clearly there will be a trade-off. The trade-off might be evaluated in terms of contributions at the margins to productivity and economic growth, but other effects on well-being and equity objectives also need to be considered. One guide to evaluating these issues are comparisons of levels and distribution of human capital across similarly developed countries. Part five will consider how New Zealand compares with other OECD countries in these respects.

[37] See OECD (2001b).

PART FOUR HUMAN CAPITAL AND WELL-BEING[38]

Human capital is positively associated with other factors affecting well-being

Individual and community levels of education have a strong association with a range of social benefits that are aspects of human well-being. Better-educated people tend to be healthier. This association may be due to a number of factors other than higher income. More educated people adopt healthier habits and life styles – for instance, they are less likely to smoke or drink heavily, and to be overweight, and they engage in more exercise. They may be exposed to fewer occupational hazards. They may be able to better access and use health related information[39].

Higher levels of education lead to lower take up of social transfer benefits (even when eligible), and, of course, through higher wages, to paying more tax (Wolfe and Haveman, 2000). More educated people conduct labour market search more efficiently and effectively. They also tend to be more efficient consumers (Rizzo and Zeckhauser, 1992).

The children of better-educated parents themselves do better at school. Moreover children in communities where the average level of education is higher are more likely to complete secondary schooling, other things being constant. Individual education levels are associated with a lower risk of crime, and there is an additional effect from average levels of education in a community[40].

Education and literacy skills are positively associated with levels of political and social engagement, and participation in voluntary community activities, as well as in resources devoted to charity. They are also associated with higher levels of trust, tolerance of diversity, commitment to equality of opportunities and resistance to political alienation[41].

Finally, education has both an immediate and long-term positive association with self-reported happiness, even when taking account of the effects of family income (Blanchflower and Oswald, 2000). Moreover, there is evidence that this is not just a relative effect – individual happiness is also positively correlated with average levels of education in the community (Putnam, 2000).

… but again causal effects are difficult to untangle

Despite this evidence, it is difficult to untangle and quantify the causal effects of education on well-being. As OECD (2001a) notes: “Some of the influences … may be mediated by the fostering of habits, characteristics and attitudes which assist job creation, productivity, personal well-being, positive time preferences and self-discipline. Some of these characteristics as well as innate abilities and attributes are formed outside formal education but are highly correlated with schooling.”

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38 The following discussion relies primarily on a summary of the evidence presented in OECD (2001a).

39 Kenkel (1991). Kenkel finds, nevertheless, that education appears to have an effect on health independent of income, race, social background and other factors, including use of health related information.

40 Sandefur, McLanahan, and Wojtkiewicz, (1989); Wolfe and Haveman (2000).

41 Verba, Schlozman and Brady (1995); Hodgkinson and Weitzman (1988); Schuller et al. (2000); Bynner et al. (2000); OECD and Statistics Canada (2000); Helliwell and Putnam (1999). Other researchers – for instance Nie, Juhn and Stehlik-Barry (1996) argue that *relative* rather than *absolute* levels of education are the key determinant of civic participation.

In addition there is the problem of reverse causality – some of the outcome measures may have a causal effect on education. The lack of consistent measurement of outcomes, and of large cross-country data sets providing regular measurement over time, make the inference of causality even more difficult than in the case of education, productivity, earnings and growth (see Appendix).

… Nevertheless, indirect effects of human capital on well-being and social outcomes could be as large as the direct effects through earnings and growth

Despite the difficulties in establishing causal effects, researchers (Wolfe and Haveman, 2000; Wolfe and Zuvekas, 1997; Bynner et al., 2000; McMahon, 2000, Schuller et al., 2000) have begun the task of attempting to quantify these benefits. One approach is to value them at the cost of alternative means of obtaining the desired outcome. These approaches typically find that the social benefits of education (controlling for direct benefits) are large – possibly larger than the direct labour market and macro-economic effects.

Summary

- Evidence suggests that, while causal effects are uncertain, human capital contributes to individual well-being through many channels, in addition to direct productivity and earnings effects.

- It follows from this that effects of low human capital on earnings may be compounded through effects on other dimensions of well-being such as health. Also, to the extent that individuals with low human capital live in communities with average low levels of human capital, they are likely to experience additional harm to their well-being, over and above that due to their own low level[42].

- Human capital formation is likely to increase individual and societal well-being, even if it does not lead to participation in the labour market. This is obviously relevant for two groups – people with disabilities that prevent such participation, and older people who are near or who have already entered retirement.

- The mechanisms discussed in this Part mostly reinforce the particular benefits for the distribution of well-being from raising human capital in the bottom part of the current distribution of skills.

- On the other hand, some of the mechanisms discussed in this section (for instance, effects on charitable giving, voluntary community participation, political participation, commitment to equality of opportunities) may be just as relevant in other parts of the distribution of skills.

[42] The issue of "neighbourhood effects" is discussed in the accompanying paper on "Geography and the Inclusive Economy".

PART FIVE THE LEVEL AND DISTRIBUTION OF HUMAN CAPITAL IN NEW ZEALAND

Comparisons with other OECD countries may help guide New Zealand's policy effort

Comparisons across countries of current levels of human capital, and measures of its quality and distribution, may be useful to guide further policy effort to increase growth and raise well-being. Trends over time, and comparisons with other developed (OECD) countries[43] may help identify areas where progress is slow, and where our patterns diverge most from those of successful countries.

Unfortunately, the measures of human capital that allow reliable comparison across countries and across time are limited in scope. They do not, for instance, usually cover managerial and entrepreneurial skills, or "softer" skills such as capacity for teamwork, problem solving and adaptability, that are likely also to be important for labour market success. In addition, it is important to note that New Zealand's economy has a different structure to other OECD countries, has followed a different historical path and has social and cultural differences. All these will probably be important for the types of human capital that are at present most relevant to growth and well-being here. International comparisons are useful, but should be tempered by these considerations.

The following discussion selects three dimensions by which to compare human capital in New Zealand to other OECD countries:

- Average education attainment in the population, and participation in post-compulsory education.
- The quality of achievement.
- The distribution of achievement.

Average education attainment, and participation in post-compulsory education

New Zealand has high average years of education in the working age population

Average years of education (working age population, selected OECD countries)

	1971		1998	
	Years	Rank (of 21)	Years	Rank (of 21)
Australia	11.1	3	12.3	5
Canada	11.4	2	12.9	2
Germany	9.7	9	13.5	1
New Zealand	10.3	5	11.8	9
Portugal	6.5	20	7.7	21
Spain	5.8	21	8.7	20
U.K.	9.2	11	11.9	8
U.S.	11.6	1	12.7	4

Source: OECD (2000b) [44]

[43] In the material that follows, a range of methods of comparison are used, including New Zealand's overall ranking amongst participating countries, and mean scores compared with selected countries. Comparator countries are selected partly because of their similar histories of education provision (the United Kingdom, Australia, Canada) or because they indicate the range of outcomes.

[44] Human capital is measured "by estimates of the average number of years of education among the working-age population, based on figures on educational attainment and assumptions about how many years of education a particular level of education represents." While this is "only a proxy" … "it is an improvement with respect to the measures generally used in the literature. It relies on OECD data on

… but its rank has slipped over the last 30 years

The increase in average years of education between 1971 and 1998 ranged from 1.1 years (the United States) to 3.8 (Germany). New Zealand, at 1.5, had the fourth smallest increase (after Portugal and Australia) followed closely by Canada and Denmark. Overall there appears to be a tendency for countries with initially high average years of education to have low growth in this variable.

Growth effects of New Zealand's falling ranking in average years of education

While the OECD (2000b) estimates should not be taken too literally, it is useful to consider what extra "steady state" output per capita would have been achieved, if New Zealand had maintained its ranking of fifth. At fifth in 1998, average years of education would have been 12.3 (the same as Australia and Japan), 0.5 of a year more than New Zealand's actual 11.8. Thus (on an extremely rough calculation using the average relationship between years of schooling and output per capita) output per capita would have been 3% higher in 1998, if New Zealand had maintained its fifth ranking[45]. To set this in context, the average annual growth rate in per capita output over the period 1974 to 1997 was 0.53%, corresponding to an actual overall increase in output per capita of 13%. As noted above the actual increase in average years of education in the working age population was 1.5.

Participation in tertiary education has increased, and is relatively high

Over this period, participation in tertiary education in New Zealand has increased, and currently is relatively high.

Expected years of tertiary education for all 17-year olds (1990, 1997):

	1990	1997
Australia	2.9	3.7
Canada	3.4	4.1
New Zealand	2.1	3.1
United Kingdom	1.2	2.4
United States	3.4	3.7
OECD country mean	1.7	2.4

Source: Education at a Glance (OECD, 2000)

New Zealand was ranked fifth on this measure (out of 25 countries) in both 1990 and 1997. At the same time, New Zealand in 1998 had the highest tertiary "net entry rates"[46] in the OECD for "Tertiary Type A ", and the second highest (after Korea) for "Type B"[47].

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education attainment and the revised Barro-Lee (1996) dataset based on the work of De La Fuente and Domenech (2000)".

[45] This calculation assumes, amongst other things, that the OECD (2000b) estimates reflect a causal relationship from education to output per capita, and that the effects are linear – an extra year of education in a country with low levels has the same effect as an extra year in a country with high levels. Thus 3% may be considered an upper bound.

[46] The meaning of the "net entry rate" measure is not intuitively obvious: "[They] … represent the proportion of persons of a synthetic age cohort who enter a certain level of tertiary education at one point during their lives. The net entry rates are defined as the sum of net entry rates for single ages. The total net entry rate is therefore the sum of the proportions of new entrants at Tertiary … aged *i* to the total

In addition, New Zealand has comparatively high survival rates in tertiary education, and among the highest graduation rates[48] from Tertiary-type A first degrees in the OECD.

New Zealand also appears to have comparatively high levels of participation in adult education and training

% of population aged 16-65 participating in adult education and training during the year preceding, 1994 – 1995

Australia	38.8
Canada	37.7
New Zealand	47.5
United Kingdom	43.9
United States	39.7

Source: OECD and Statistics Canada, 1997

New Zealand ranked highest amongst the 12 participating countries on this measure and also ranked highly on mean hours of study. Participation was particularly high for those aged 16-25.[49]

… but participation in formal education at ages 16-18 is comparatively low

On the other hand, New Zealand ranks much lower on expected years of upper secondary education[50] and on overall education participation in this age range. Out of 29 OECD countries, New Zealand ranked 11th in expected years of upper secondary schooling, in 1998. For education net enrolment rates (combining secondary, and post-secondary non-tertiary and tertiary) at ages 16, 17 and 18, New Zealand ranked 21st out of 28, 24th out of 28 and 22nd out of 27, respectively (OECD, 2000a).

Summary

Taken together, this data does not suggest that New Zealand should be aiming, as a primary policy focus, to expand years of education in tertiary education, or to increase overall tertiary enrolment rates. There may be some grounds for aiming to increase participation in the senior secondary school, or in equivalent education at the ages of 16 through 18. This is a policy that is likely both to increase average years of education in the working age population, and to raise achievement in the bottom 20% of the distribution of skills.

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population aged *i* at all ages." New Zealand's high ranking may partly reflect unusually high entry rates at older ages.

47 Tertiary-type A programmes are largely theory-based and designed to prepare students for advanced research programmes and highly qualified professions. Programmes of Tertiary-type B are designed for direct entry into the labour market. In New Zealand, every second young person is expected to enter Tertiary-type A education.

48 This refers to the rate of graduation per population, and, for most countries, is calculated in a similar way to net entry rates (see footnote 46).

49 Full-time students, not in the labour force, are excluded from this definition of participation in adult education and training.

50 This data should be read in conjunction with expected years of tertiary education, where New Zealand ranks highly. In some countries (e.g. Sweden) upper secondary schooling is a substitute for tertiary education.

Quality of achievement

On average, New Zealand students do very well in reading literacy, but rather less well in mathematics and science …

In the two (1970 and 1990) International Educational Association surveys of reading literacy of school children, New Zealand ranked at or near the top (for 1990, see Elley, 1992). Given the fairly wide distribution of scores (see below) this implies that the better New Zealand students did particularly well.

On the other hand, in two (1981 and 1994/95) surveys of mathematics and in one (1994/95) of science skills, New Zealand ranked amongst a middle group of countries for 13 & 14 year olds[51]. For instance, in 1994/95 of 25 countries who fully met the survey requirements, New Zealand ranked 15th for 14 year old mean scores.

Mean mathematics achievement scores of 14 year olds in year eight of schooling 1994 – 1995 – selected countries

Australia[52]	530
Canada	527
England	506
New Zealand	508
Singapore	643
United States	500

Source: Beaton et al. (1996)

…though by the final year of schooling the top 25% of New Zealanders are performing well in mathematics

New Zealand performed better for students in the final year of schooling, ranking at fourth or fifth[53]. In 1994 the top 25% of the cohort at the age of final year of schooling in New Zealand ranked third, after Sweden and Switzerland[54].

This suggests that New Zealand does not have a particular problem with quality of foundation literacy and mathematics skills in the top half of the distribution of skills. This conclusion is reinforced by the extent to which New Zealanders are able to access top ranking tertiary education institutions overseas.

New Zealand's performance in measures of adult literacy and numeracy is on average mediocre

The International Adult Literacy Study, 1994/95, provides direct measures of skills in the working age populations in 12 participating countries. The survey tested skills on three scales – "prose", "document" and "quantitative". "Prose literacy" refers to the ability to understand and use information contained in various kinds of text. "Document literacy" refers to the ability to locate and use information displayed in materials such

[51] In 1994, New Zealand ranked 25th and 24th out of 39 countries for mathematics achievement of 13 and 14 year old students respectively. Average scores were not statistically different to those in England, Scotland, the United States, Sweden, Denmark and Norway.

[52] Did not satisfy guidelines for sample participation rates.

[53] Mullis et al. (1998).

[54] Four east Asian countries which performed better than New Zealand at lower levels did not participate in the final year survey. Nevertheless, in the final year survey New Zealand improved its ranking against a number of countries which participated in both. The result for the top 25% of the cohort should remove any effects due to selection into the final year of schooling.

as schedules, charts, graphs, tables, maps and forms. "Quantitative literacy" refers to the ability to extract numerical information from various sources, and to perform arithmetic operations to make use of it.

Adult literacy is likely to reflect a number of factors, but particularly the quality of initial education; access to and quality of adult education and training; the skills of migrants[55], and "learning by doing" on the job.

Apart from the extremes of Sweden and Poland, mean scores across participating countries did not exhibit a wide range. Of the 22 participating countries or regions, New Zealand did significantly better than 11 on the prose scale, six on the document scale, and five on the quantitative scale. Conversely, it did significantly worse than four on the prose scale, 11 on the document scale, and 13 on the quantitative scale. As noted in Part two, raising numeracy appears to have a strong effect on improving labour market outcomes at the bottom of the distribution.

Mean adult literacy scores 1994-1995 – selected countries:

	Prose	Document	Quantitative
Australia	274.2	273.3	275.9
Canada	278.8	279.3	281
New Zealand	275.2	269.1	270.7
Poland	229.5	223.9	234.9
Sweden	301.3	305.6	305.9
United Kingdom	266.7	267.5	267.2
United States	273.7	267.9	275.2

Source: (OECD & Statistics Canada, 1997& 2000)

New Zealand produces engineering and science graduates at comparable rates to other English speaking OECD countries

Part one discussed evidence that the production of engineering and science graduates may be particularly important for economic growth in OECD countries,[56] and it is also commonly argued that New Zealand produces too few of such graduates. However, New Zealand appears to have a comparatively high rate of production of graduates with first Tertiary-type A qualifications[57] in engineering and science:

Engineering and science graduates as a proportion of synthetic age cohort

Australia	3.9%
Canada	6.6%
New Zealand	6.3%
United Kingdom	7.5%
United States	4.3%

Source: OECD (2000a)

[55] For two decades at least, the average educational attainments of adult migrants to New Zealand have been better than those of the native population (See Winkelmann 1999, Table 4).

[56] See for instance Ochoa (1994) and references in Romer (2000), Hanushek and Kimko (2000).

[57] Calculated from data in OECD (2000a). Graduation rates are rates per relevant population and are calculated in a similar way to net enrolment rates (see footnote 46). Note that several categories of degrees have been combined to reduce problems with different classifications across countries.

On the other hand, New Zealand has a relatively low rate of graduates from advanced research programmes (Ph.D or equivalent). This may partly be due to students choosing to do advanced degrees overseas.

This of course is a very crude measure of the relevance of tertiary education outputs to improving productivity and economic growth.

More broadly, recent Treasury analysis[58] suggests that there is little evidence in New Zealand of persistent, or consistent skill shortages. Shortages mostly emerge during periods of expansion, and there is little evidence of firms' productive capacity being harmed by shortages[59]. Even in times of high relative shortages, the impact is not large. However, better data and econometric analysis of the type represented in Nickell & Nicolitsas (1997) might reveal longer-term effects of persistent relative skill shortages in particular industries, on research and development and capital investments. This is consistent with the mechanisms discussed in Part one.

Finally, other evidence (from surveys of opinion) suggests that quality of managers, and management training is lower in New Zealand than in countries such as Australia, Canada, Finland and Ireland. The same evidence also suggests that New Zealand rates poorly in "average number of years of schooling to support highly competitive industries" and the extent to which "staff training [is] heavily emphasized", which is at odds with the evidence presented above from more objective sources. It is not clear that comparisons across countries on these survey results represent objective differences[60].

Distribution of achievement in New Zealand

On most measures, New Zealand has a comparatively wide dispersion of scores …

While in international comparisons New Zealand ranks highly on some measures (literacy in schools) and amongst a middle group of countries on others, along with a group of mainly English speaking countries, it has a wider dispersion of achievement. This implies, for a given mean score, a longer tail of low achievers. This is illustrated in the following data from the 1990 IEA Reading Literacy Study, particularly in the data for 14 year olds. Whereas New Zealand ranks highly for students at the 75th percentile, and on mean scores, its ranking at the 25th percentile is much lower[61] – indicating a long tail of low achievers:

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58 Treasury (2001a).

59 It is relevant to note that New Zealand has a net influx through migration of science and engineering professionals, averaging 5% of this workforce per annum (information supplied by the Ministry of Research Science and Technology). There are issues of settlement and absorption into the workforce, that need to be taken into account.

60 Evidence from the Global Competitiveness Report 1999, cited in IMF (2000). IMF (2000) notes: "Survey data are necessarily subjective and especially in some areas, may be subject to large measurement errors which could, in turn, lead to a misleading picture of relativities across countries".

61 In this study, New Zealand's ranking for students whose home language was different to the school language was particularly poor – 21st for both nine year olds and 14 year olds. Elley (1992) notes that this largely reflects the performance of Pacific Island students. Other analysis (Grisay, 1995) shows that this relatively poor performance could not be explained by controlling for socioeconomic factors. It should be noted however that there were differences across countries in the extent to which migrant children were included in the survey.

New Zealand's rankings at the quartiles and on mean scores
IEA 1990 Reading Literacy Study

		25th	Mean	75th
9 yr olds				
(27 countries)				
	narrative	**7**	4	3
	exposition	**7**	6	6
	documents	**7**	8	5
14 yr olds				
(31 countries)				
	narrative	**11**	5	1
	exposition	**15**	8	3
	documents	**10**	3	2

Source Elley (1992)

However, this pattern is not evident in the 1994–1995 third international mathematics study, where New Zealand's rankings for 13 and 14 year old students was much the same (but middling amongst the 25 to 27 countries who fully met the survey requirements) at the 25th, 50th and 75th percentiles. Compared to the literacy study, reduced dispersion of scores in mathematics appears to be related to lower average scores[62].

Similarly, in the 1994-1995 International Adult Literacy Study (IALS), on each of the three scales, New Zealand ranks much the same at the 25th and 75th percentiles, and at the mean. Nevertheless, along with Poland and some English speaking countries (the United Kingdom, the United States, Canada and Ireland), New Zealand has a relatively high dispersion of scores, as measured by the inter-quartile range[63].

The IALS scales are divided into five levels, with level one the lowest[64]. Along with the United Kingdom, United States and Ireland, New Zealand has a larger share (around 20%) of its working age population at the lowest level on all three scales than most of the other 13 participating countries. Conversely, it has a relatively high share at levels 4 and 5 on the prose and document scales, but not on the quantitative scale.

… and appears to be falling further behind many other countries

There is tendency in the IALS for younger cohorts to achieve higher average scores than older cohorts. This is less marked for New Zealand (see table below).

[62] Dispersion of scores in this study, as measured by the inter-quartile range, appear to be correlated with mean scores. Countries with high mean scores also tend to have high dispersion, while those with low scores have low dispersion. With a middle range score, New Zealand also has a middle range dispersion of scores.

[63] Defined as the distance between scores at the 25th and 75th percentiles.

[64] Level 1 "indicates persons with very poor skills, where the individual may, for example, be unable to determine the correct amount of medicine to give a child from information on the package… Level 3 is considered a suitable minimum for coping with the demands of everyday life and work in a complex, advanced society". (OECD & Statistics Canada, 2000).

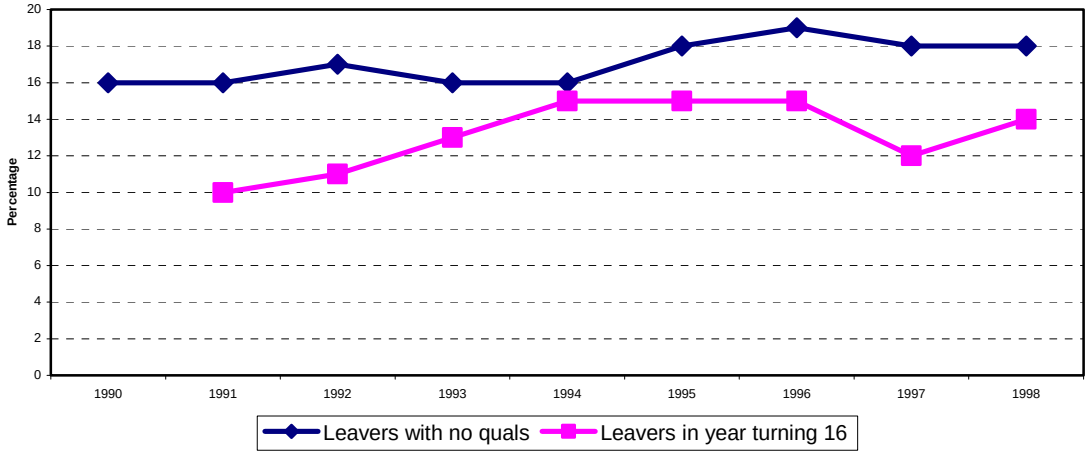
% of population 16-25, and 46-55 at document literacy level 1 (the lowest) 1994-1995

	16-25	46-55	Difference
Australia	9.7	23.6	13.9
Canada	10.4	23.0	12.6
New Zealand	18.3	22.3	4.0
Sweden	3.1	6.8	3.7
United Kingdom	17.8	24.5	6.7
United States	24.7	21.4	-3.3

Source: (OECD & Statistics Canada, 1997)

This suggests that New Zealand is not keeping up with improvements in other countries. This may be associated with early school leaving and relatively low participation rates of 16, 17 and 18 year olds in education (see below)[65]. The data thus suggests that the qualifications reform, and school retention policies of the 1990s have not made much difference to the bottom 15-20% of school leaving cohorts.

Early and unqualified school leavers



Source: Ministry of Education/Education Statistics of New Zealand, 2000[66]

Summary

The evidence suggests that, compared to many other countries, there is considerable scope in New Zealand to improve skills in the bottom 20% of the distribution of skills, and that this will have beneficial effects on well-being, income dispersion, and, to some extent at least, on output per capita.

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[65] It may also be connected to patterns of qualifications of school leavers. However, here it should be noted that the two most common forms of qualifications for school leavers – the school certificate, and sixth form certificate – are essentially norm referenced, meaning that a proportion of each cohort is always going to not obtain them. On the other hand, new forms of qualifications were introduced during the 1990s designed in part to make it easier for non-academic students to gain recognition of learning, and participation in the senior school increased sharply.

[66] "Early school leaving" is defined in terms of the numbers who have apparently left school in the year that they turn 16, and is constructed from age specific enrolment data in consecutive years. In the early part of the period, a significant but decreasing group will have left in the year they turned 15. Note that the data presented in this diagram does not adjust for business cycle effects on school leaving. 1991-96 was a period of rising labour demand.

The evidence does not suggest that New Zealand needs to expand tertiary education further, at least at a rapid rate. To the extent that there are concerns about quality and fit with the demands of the economy, a range of policy approaches may be indicated. A key may be to use funding policy and institutional arrangements to ensure the development of a cadre of highly skilled individuals needed to adopt and implement promising new technologies.

Comparison with Australia highlights areas where New Zealand lags

Given a degree of similarity in educational and cultural history, it is informative to compare New Zealand directly with Australia on the above measures:

Measure		Australia	New Zealand
Ave. yrs of ed. in working age pop. 1998		12.3	11.8
Expected yrs tertiary ed, 17 yr olds, 1997		3.7	3.1
Tertiary net entry rates[67] 1998	Tertiary-type A	53%	68%
	Tertiary-type B	missing	36%
Participation rate in adult education & training 1994-95		38.8%	47.5%
1998 education enrolment rates at age	16 yrs	97%	88%
	17 yrs	91%	72%
	18 yrs	67%	55%
Ave. maths achievement scores,1994-95[68]	14 yr olds	530	508
	Final yr of school	525	525
	Top 25% of final yr age cohort	620	621
Ave. IALS scores 1994-95	Prose	274.2	275.2
	Document	273.3	269.1
	Quantitative	275.9	270.7
IALS inter-quartile range	Prose	69.9	74.6
	Document	68.2	78.2
	Quantitative	70.6	76.1
% of population at document literacy level 1	Aged 16-25	9.7%	18.3%
	Aged 46-55	23.6%	22.3%

In summary, the data suggests that Australia and New Zealand have similar average levels of achievement with New Zealand having a somewhat greater dispersion of

[67] See footnote 46. The figure is an entry rate for a "synthetic cohort" based on current patterns of entry, and designed to allow comparison across countries. Actual entry rates for particular cohorts will be much lower.

[68] For the final year study, Australia excluded 5.5% of the sample, while New Zealand excluded none. However, this difference does not affect the measure for the top 25% of the cohort. At the 14-year-old level, Australia achieved much lower sample participation rates, which needs to be taken into account in comparing average scores.

scores in the adult measures. There is some suggestion that New Zealand is falling behind in skills at the bottom of the distribution over time.

New Zealand has higher tertiary entry rates, but it appears that Australians who undertake tertiary education do so for a somewhat longer period of time. On the other hand, working age New Zealanders are more likely to be participating in other forms of adult education and training. The most marked participation differences are in education enrolments across the ages 16 through 18, where Australia has considerably higher rates than New Zealand. Overall on average, Australia's working age population has more years of education than does New Zealand's.

Of all the English-speaking countries in the OECD, Australia has patterns of education participation, attainment and achievement that are most like those of the Scandinavian and other European countries such as Germany, the Netherlands and Denmark.

What accounts for these different patterns? One possibility is differences in the occupational and industrial composition of the economy, creating different demands for skills in the workplace, and different opportunities to acquire them. IALS data shows that in 1994-95 44% of the New Zealand and 39% of the Australian labour force were employed in jobs classified as low skilled. On the other hand, skills used in the workplace are likely, to some extent, to reflect the supply of skills in the labour force.

Another possibility is that skills held by older generations differ, and this is reflected in the skills acquired in the younger generation. However, the IALS data suggests that the skill profiles of the 46-55 year old cohort in New Zealand and Australia are much more similar than the profiles for the 16-25 year old cohort. Other possible explanations include differences in education systems (a much larger proportion of primary and secondary education is privately provided in Australia, for instance), and relatedly, differences in government policies towards education (higher rates of economic growth in Australia allows higher per student expenditures, for instance; Australia introduced a vigorous range of policies to promote participation in post-compulsory secondary and vocational education in the early 1990s).

PART SIX OPPORTUNITIES TO IMPROVE WELL-BEING THROUGH HUMAN CAPITAL POLICIES IN NEW ZEALAND

Raising skills in the bottom of the distribution of skills provides the greatest opportunity to improve well-being in New Zealand

The argument in Parts one to five lead to the conclusion that the greatest opportunity for improving well-being in New Zealand, using human capital policies, is to focus on raising achievement in the bottom of the distribution of skills – particularly the bottom quintile.

Early interventions are the most cost-effective in the long run

There are two issues here – how to reduce the numbers of young people leaving education without adequate skills to secure stable employment, and how to improve skills for those already in the workforce. Because of the cumulative nature of educational investments, early interventions in pre-school and primary education are likely to be most cost-effective in the long run.

The period from birth (even pre-birth) to school age is a critical development phase with life-long effects on well-being. Intensive early childhood interventions can be effective in improving a range of both short and long term outcomes for disadvantaged children[69]. However, such interventions are relatively expensive (compared to regular early childhood education), targeting instruments are not perfect, and it may be difficult to engage the most disadvantaged families. Therefore interventions need to be carefully designed in terms of the age of the child, their targeting on risk factors and their mix of child-focussed and parent-focussed elements. Intensive very early interventions for children most at risk may be important, given rapid brain development that takes place in these years.

Good quality standard early childhood education also appears to have a beneficial effect, in particular for disadvantaged children, but again it is difficult to ensure that the most disadvantaged children access provision. In addition, there is evidence that some of the benefits of pre-school interventions – particularly higher cognitive skills – are lost, if primary education is of insufficient quality[70]. Primary schooling is thus of key importance in addressing the risk of low achievement.

Of particular importance are foundation skills in literacy and numeracy that provide the platform for later learning both in school and the workforce. Such skills have been shown to have a strong link with labour market success independent of levels of education (OECD and Statistics Canada 1997; Hanushek and Kimko, 2000; Maré and Chapple, 2000 for New Zealand).

Basic literacy and numeracy are particularly important …

Recent research in the United Kingdom (Machin et al. 2001) suggests that raising numeracy skills is particularly important for improving labour market outcomes for those in the lower part of the distribution of skills (while improving literacy has a stronger effect for those who are already well skilled). The research also suggests that basic literacy and numeracy have a more important and more robust effect than a range of other "soft skills" and attitudes on labour market outcomes.

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69 See, for instance, Waldfogel, (1999).

70 See Nechyba et al. (1999).

… as recognised in many jurisdictions

Many jurisdictions – for example the United Kingdom, and many states in the United States, have put increasing emphasis on the acquisition of such skills during elementary schooling – for instance, by putting in place standardised measurement of progress, at individual, school and national level.

Improving literacy and numeracy in the United Kingdom

Over the 1990s successive British governments first instituted national tests of literacy and numeracy at ages seven, 11 and 14, and, under the current government, mandatory literacy and numeracy hours, together with national targets for the percentage of 11 year-olds passing the 11 year-old norm in 2002. The following table shows that these measures have been highly successful in increasing the percentage of 11 year-olds passing the norms. The ambitious targets for 2002 are likely easily to be met. Currently, attention is being focused on ensuring that children at the bottom of the achievement distribution reach minimum standards.

Percentage of 11 Year-Olds achieving their norm (UK)		
	Literacy	Numeracy
1996	57	54
1997	63	62
1998	65	59
1999	71	69
2000	75	72
2002 (target)	80	75

Source: Layard et al. (2000)

A range of interventions may be effective. By and large, they will need to pay particular attention to local design and adaptation of policy. In particular, they will need to find ways to engage families and communities in pursuing meaningful objectives for their children, recognising the important contribution that each makes to children's outcomes. The Strengthening Education in Mangere and Otara (SEMO) initiative is a promising recent New Zealand example of such an approach. A key issue is how to generalise such an approach to other disadvantaged communities, given scarcity of skilled human resources, and the costs involved.

Strengthening education in South Auckland

The Strengthening Education in Mangere and Otara (SEMO) initiative commenced in 1997 in response to an Education Review Office (ERO) report criticising the quality of education in many South Auckland schools. It aims to strengthen schools in Mangere and Otara by improving their capacity to manage themselves. The Ministry of Education provides extra assistance to this end.

SEMO's design reflected recent research on school improvement that emphasised the importance for sustained gains of involving both schools and community groups. Relevant resources (aspirations for children, understanding of what is needed to reach them and the skills to do so), are more likely to be identified and aligned through such an approach. The initiative worked within national education policy parameters, and the culture, politics and recent educational history of Mangere and Otara. It thus aimed to be a *partnership* between the state and the local communities, families and schools.

Evaluation (Robinson et. al., 2000) shows that considerable obstacles (the historical pattern of relationships and expectations, suspicion of state interventions, expectations of management autonomy, community loss of confidence in the local schools) stood in the path of achieving partnership. Over time, through learning from the feedback of the various communities, schools, and evaluators many of these obstacles have been overcome, resulting in the establishment of effective partnerships.

The evaluators note the importance of SEMO activities (which are complex and diverse) focusing on the central objective of sustainable improvement in students' achievement. Activities not so focused can "wittingly or unwittingly divert the attention and effort that is needed to achieve this goal". SEMO has been successful in gaining community and schools support for this goal.

A current activity in 13 schools is a programme of teacher professional development on the analysis and use of student achievement data. Already, an evaluation of another component of SEMO, a teacher development programme focused on early years of schooling, indicates that it is substantially improving the chances of children from low-income families reaching national standards of literacy achievement[71].

More generally, there is a long-standing debate in the empirical literature about how far schools' resourcing levels are important for improving achievement outcomes. A wide range of studies fails to find any consistent relationship between resources and outcomes. However, recent evidence from experimental use of smaller class sizes and more careful use of other data has begun to uncover the relationships expected[72]. The evidence suggests that persistent reductions in class-size are an effective means to improve achievement and later employment outcomes for disadvantaged children, particularly in the earlier years of schooling. However, whether or not this is the most cost-effective means requires further investigation. Certainly, the consensus is that any such policy needs to be accompanied by other measures to maximise the gains.

Evidence on effective programmes to raise basic skills amongst adults is weak

Addressing low levels of human capital in the adult population raises different issues. First evidence suggests that pre-employment labour market and basic skills training is not very effective in securing better labour market and earnings outcomes for low

[71] Personal communication from Ministry of Education, including preliminary data from an evaluation.

[72] Grissmer et al. (2000), Krueger & Whitmore (2000) and Boozer & Maloney (2001). The last study is based on data from the Christchurch Health and Development Survey.

skilled adults[73]. In the short to medium term, evidence supports concentrating on getting persistently unemployed persons into work as a first priority. On the other hand, policies that concentrate on human capital accumulation may eventually match "work first" policies in effectiveness (though not cost-effectiveness), over the longer term (see Hotz et al, 2000). In addition human capital policies appear to have important benefits both for individuals and their families, other than improving labour market outcomes[74]. These need to be taken into account, to the extent that the evidence on causal effects is strong.

There may also be a role for improving the quality and quantity of training available in employment for the low skilled (Acemoglu 2001a)[75]. As is currently the policy in New Zealand, government financial support for and certification of employer based training may assist. As noted above, New Zealand already has high rates of participation in adult education and training. Unfortunately those who reach working age with low skills are the least likely to be employed, and if employed, to receive training (OECD and Statistics Canada, 1997). It may be possible to bundle support for employment-based training with other policies aimed to assist the low skilled into work.

More generally, it should be recognised that people in the bottom 20% of the distribution of skills vary widely in the characteristics that are associated with their low skills. Some will not be able to benefit from human capital policies in terms of improved labour market attachment[76], but may nevertheless benefit for other reasons.

Overall, there is a need to get a better understanding of what policies are effective for the adult population, in which circumstances and for whom. This can only be achieved through experimentation and good evaluation of policies as they are implemented in New Zealand, and drawing on learning from other jurisdictions. It also requires a better understanding of the characteristics of people who have persistent difficulties in securing stable employment.

There is an important ethnic dimension to raising skills

Maori and Pacific peoples are over-represented among the low skilled. This poses an important challenge to a well-functioning society, particularly to the extent that it is seen to have resulted from unfair processes in the past and present. Cultural and historical factors have important implications for the design of interventions to raise human capital among Maori and Pacific peoples.

These issues are canvassed in the Treasury report "Closing the Gaps Framework" completed in 2000.

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[73] Heckman (1999) provides a useful summary of the evidence on this point. Numerous other studies show similar results. A recent U.K. study (Brooks et al, 2001) finds that, though potentially important in improving outcomes, "there is an absence of intervention studies exploring what factors in teaching basic skills cause progress in learning basic skills".

[74] Johnson (2000) describes a "relatively new" approach in the U.K. and the U.S. which bundles programmes for children and adults into "Family Literacy". Research shows that adults in such programmes stay enrolled for longer than in most adult-only programmes, and had better learning gains. Children also made achievement gains. See also Brooks et al. (2001).

[75] Johnson (2000) cites Australian and U.S. research showing the benefits of workplace literacy programmes for both employees and employers. In general however, there is a dearth of reliable data on or evaluation of the longer run effects of such programmes on productivity (and earnings).

[76] Evidence from the United States suggests that even with a buoyant economy, people with very low cognitive skills, or problems with mental health or substance abuse, will still find it difficult to secure stable employment. A different set of policies is required to prevent or ameliorate the effects of these factors on life chances.

New Zealand can benefit from policies that improve the quality and relevance of selected areas of tertiary education

The other issue that stands out is whether human capital policies can be better designed to support the processes of technology adoption that underlie economic growth. As noted above, this first requires leading-edge technical, managerial and entrepreneurial skills to identify and adapt new technologies to production. Given that most new technologies will be created abroad, leading-edge experts need to build and maintain good linkages internationally – as well as with local industry. Technological progress also requires a workforce with good general skills to operate new "skill-biased" technologies.

The literature suggests that a key issue is providing a policy environment that encourages students, tertiary education providers and industries to make complementary investments.

New Zealand has high rates of participation in tertiary education…

New Zealand has been remarkably successful in rapidly increasing output of tertiary graduates over the last 15 years[77], while keeping real government outlays tightly constrained. This has been achieved through bulk funding tertiary institutions on the basis of student numbers, with students expected to contribute a part of tuition costs (able to be financed through student loans). This bulk funding includes an element to cover research – but does not provide strong incentives for excellence in research.

Quality assurance systems are designed to ensure tertiary providers exceed minimum standards. The main mechanism to achieve responsiveness of provision to the needs of the economy is student demand for courses, which in turn is postulated to depend on differences in labour market returns to educational investments. Certainly high private rates of return to tertiary education appear to have been a significant driver of increased participation in New Zealand.

…but competes in an international labour market for the most skilled academic workers

However, New Zealand is a small, remote, open economy that operates in an international labour market for the most skilled workers. It is competing with a number of higher income countries for the best academic workers. It is very unlikely that policies that aim at a uniform standard across the system, will reliably produce world class centres of research and teaching – no country has the resources to afford a uniformly world class standard of provision in its universities.

Careful funding and institutional design is required to increase the incidence of world class tertiary research and teaching in an affordable way

While some recognised centres of excellence do exist, it is possible that a careful choice of funding and institutional arrangements could lead to the emergence of more, in areas of particular relevance to economic growth. Encouraging selected areas of world-class provision requires internationally competitive salaries. Building on emerging centres of excellence, particularly where they can demonstrate effective linkages with relevant industries, and with overseas centres, could reduce the risk of wasted resources[78]. Internationally, it is not uncommon for research centres (often

[77] Numbers of students graduating with bachelors degrees increased by 260% between 1990 and 1999, and numbers with post-graduate degrees by almost 300% (information supplied by the Ministry of Education).

[78] The importance of "close and synergistic links", and cost sharing arrangements between government and industry, is emphasised in IMF (2000).

associated with teaching) to be funded through a tendering process which provides sufficient continuity to allow strategic investments to be made, but which also provides strong incentives for performance.

New Zealand can support only a limited number of such centres – but they could play a significant role in the identification and adoption of new technologies (and, in some areas, the creation of new technologies) by attracting and retaining top staff and students, and building linkages with industry across which knowledge can be transferred[79]. The particular design of institutions and funding arrangements are likely be important for giving industry, students and tertiary managers the confidence to make the investments that will yield productivity gains in the longer term. A degree of experimentation may be required to find the best policies.

Summary

Policies to raise tertiary performance do not require large amounts of extra government resources

Policies aiming to increase the incidence of world-class tertiary education and research relevant to industry do not require large additions to existing publicly provided resources. This will involve only a small proportion of all tertiary provision, and high private rates of return provide strong incentives for individual students to contribute their own resources (assisted by the student loan scheme). More selective funding, coupled with suitable institutional arrangements could lead to significant improvements[80].

… raising skills at the bottom may require more, but the potential benefits are large

On the other hand, determined efforts to reduce the incidence of low skills among new entrants to the working age population are likely to require significant additional resources – but again careful work is required to identify the most cost-effective policies. Much less is known about the capacity to raise basic skills in the adult population – suggesting a cautious approach, with expansion dependent on successful evaluation. Recent work in the United Kingdom (Bynner et al., 2001) suggests that if successful in raising skills, such initiatives could have substantial benefits not only for the individuals concerned, but also for social outcomes, productivity, economic growth and fiscally.

[79] For instance, Adams et al. (2000) report evidence that Industry-University Cooperative Research Centers (IURCs) in the U.S. promote technology transfer. IURCs are small academic centres that depend mostly on industry support.

[80] This argument is reinforced by the fact that New Zealand's ratio of per student expenditure in tertiary education to that in primary (or secondary) is comparatively high among OECD countries (see footnote 3).

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APPENDIX

Comment on issues in the interpretation of empirical evidence on human capital

Cross-country growth regressions

Brock and Durlauf (2000) raise three main "questions" about current empirical practice in the study of the determinants of growth. These are relevant to deciding how much weight to place on the available evidence – particularly that presented in OECD (2000b).

Model uncertainty due to theory uncertainty

Cross-country growth regressions are limited by data availability and low degrees of freedom in the variables that can be included. Due to multicollinearity and missing variable bias, estimated co-efficients can vary widely in different specifications. Growth theory is "open ended" as to which variables should be included[81]. Brock & Durlauf consider that previous strategies (e.g. extreme bounds analysis) to address model uncertainty are insufficiently systematic, (and in some respects misguided), to yield useful predictions for policy purposes[82].

The most recent OECD study (OECD, 2000a) appears to take considerable care in testing the robustness of the co-efficient estimates across a range of different specifications, including: introduction of country-specific time dummies; sample variations across countries and over time; estimation of standard cross-country regressions and panel data regressions based on five-year averages; identification of and controls for outliers; exclusion and inclusion of various countries. However only a limited range of variables (guided by theoretical considerations about their influence on growth) are included in alternative specifications. The order of magnitude of the co-efficient on human capital is robust to all these specifications.

Nevertheless, the study probably falls considerably short of the sort of policy focused systematic testing and summarising of the results of alternative models recommended by Brock and Durlauf. The OECD (2000a) authors themselves note that the human capital variable may be picking up the effects of omitted variables.

Model uncertainty due to heterogeneity uncertainty

According to Brock and Durlauf (2000): "The vast majority of empirical growth studies assume that the parameters which describe growth are identical across countries… the assumption of parameter homogeneity seems particularly inappropriate when one is studying complex heterogeneous objects such as countries". Moreover, a number of studies have shown this assumption to be incorrect.

OECD (2000b) addresses this issue reasonably well, in two ways:

- The sample is restricted to a number of countries where an assumption of homogeneity is more plausible.

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81 "…one finds that well over 90 variables have been proposed as potential growth determinants … each one of which has some ex ante plausibility".

82 Brock & Durlauf go on to recommend a policy-relevant econometrics which explicitly identifies the objectives of the policy maker, and then calculates the expected consequences of a policy change. In practice this involves systematically testing, summarising through "model averaging" and evaluating the results from a range of specifications which include the policy relevant variable and accounts for model uncertainty.

- The assumption of homogeneity across countries is limited to a small number of variables that are, on theoretical grounds, believed to influence the long-run steady state output path. The assumption is tested in the data.

Direction of causality

Brock and Durlauf (2000) note: "Many of the standard variables which are used to explain growth patterns – democracy, trade openness, rule of law, social capital, etc. are as much outcomes of socioeconomic relationships as growth itself". Hence simple regressions should not be interpreted as structural. Even the use of instrumental variables is likely to be flawed, given model uncertainty (it is difficult to eliminate the possibility that an instrumental variable is correlated with omitted growth factors in the regression).

Commenting on a similar study to OECD (2000b), de la Fuente[83] argues that this is less likely to be an issue where human capital is measured as a stock rather than through enrolment rates – because the stock changes only slowly over time. This argument is not conclusive, because investment rates may be correlated with (anticipated) growth rates – faster growing countries may invest more resources in increasing the stock of human capital – and it is variation in the latter across countries and across time that is identifying effects in the regression analysis in OECD (2000b). For instance, a recent study, Bils and Klenow (2000), concludes that much of the association runs from growth to schooling.

Measurement error

Recent studies (e.g. Krueger and Lindahl, 2000; de la Fuente and Domenech, 2000) show that earlier work on the relationship between the stock of human capital and economic growth was subject to significant measurement error in the human capital variable. This appears to explain the failure of many earlier studies to find a significant relationship, particularly when change in the human capital stock was used as the dependent variable (thus magnifying the effect of mis-measurement). OECD (2000b) uses a much-improved dataset constructed by de la Fuente and Domenech for OECD countries, and this undoubtedly contributes to the much stronger relationship found.

On the other hand, as David (2001) points out, even the best measurement of average years of schooling remains a very crude proxy for the diverse theoretically relevant concepts of human capital. Relevant dimensions not captured include the quality of education (in some studies proxied by results in internationally comparable achievement tests; in others, by resource inputs), and how education is distributed among the employed workforce, as opposed to the working age population. Other models (see Romer, 2000) suggest that it is the numbers of scientists and engineers that is relevant, through effects on research and development, and technology creation and adoption.

Microeconomic evidence

As Temple (2000) notes: "The evidence that earnings are positively associated with schooling is robust and uncontroversial; the obvious difficulty lies in giving this association a causal interpretation".

An important empirical problem is the omission (through lack of data) of variables that are correlated with both schooling and earnings – such as family background, and

[83] Cited in OECD (2000b) Annex 3, and referring to de la Fuente and Domenech (2000).

ability. If more able individuals have higher earnings regardless of education, then the effects of education on productivity are likely to be overstated. Another related problem is that the costs and benefits of education are likely to differ across individuals, and may be thus correlated with the explanatory variables (such as years of schooling), thus also leading to biased estimates.

Econometricians have attempted to overcome these problems using a range of techniques. They have mainly used situations – so-called "natural experiments" – where variations in schooling occur for reasons likely to be independent of the unobserved characteristics (e.g. ability) of the individuals studied. These techniques tend to find that labour market returns to schooling are similar to those found in conventional studies.

Nevertheless, even these studies are not conclusive. A further set of models suggest reasons why earnings may be correlated with schooling even if schooling has no effect on productivity. High-ability individuals, who find schooling less difficult, may stay in school for longer because this decision signals their ability to employers. The results from "natural experiment" studies can be interpreted in a way consistent with these studies.

Signalling models predict that the social returns to education (in terms of earnings) will be lower than the private returns. Acemoglu and Angrist (2000) use historical variations in compulsory schooling laws across states in the United States as a way to test this, and find that social and private returns to additional years of schooling are very similar. Acemoglu (2001b) concludes from this that signalling effects are likely to be weak (at least at this level of schooling)[84].

More generally, the problems in inferring a causal relationship between education and labour earnings are likely to apply *a fortiori* to the relationship with other outcomes that influence or constitute well-being. Available data sets and research effort focussed on these issues are many times weaker than in the case of education and earnings.

Similar issues apply in understanding the determinants of educational achievement and attainment[85]. Consequently, considerable care is needed in interpreting the empirical evidence to select suitable human capital policies to improve outcomes. Uncertainties in the evidence need to be identified, and factored into policy design, taking account of the risks inherent in the nature of the proposed policy. Experimental design and evaluation may sometimes be the best means to provide sufficient confidence to justify large-scale implementation of new policies.

[84] Acemoglu and Angrist interpret their results as showing that positive productive externalities to schooling are also weak. To the extent that differences in compulsory schooling laws reflect differences in the demand for child labour, and these differences reflect labour market conditions that persist into the future, the results of this study are open to other interpretations.

[85] Nechyba et al. (1999) provide a very clear account of these issues.